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NORTH AMERICAN REVIEW.

No. DXLVIII.

JULY, 1902.

THE STORAGE BATTERY AND THE MOTOR CAR.

BY THOMAS A. EDISON.

THE final perfection of the storage battery, which I believe has been accomplished, will in my opinion bring about a multitude of changes and improvements in our business and social economy. No one of these will interest the public more just now than the doing away with the chauffeur, the irresponsible instrument, in the public eye at least, of so many recent accidents with automobiles.

Of the new storage battery, which was admirably described in *Harper's Weekly* last December, and about which a great many erroneous and unauthorized statements have since been made, I can now say that it has sustained and overcome the four thorough tests applied to it, and it is now, at this writing, undergoing the fifth, and last, with every prospect of the same result.

These four tests, which I will describe briefly, and this fifth now in progress, point to the new nickel-iron battery as being in fact the only real storage battery known. The attempts to compare its performance with those of the lead storage batteries, so called, now in use in automobiles and elsewhere for lack of something better, make it not improper to declare the facts. A real storage battery must be reversible, like a dynamo, which converts power into electricity and *vice versa*.

A storage battery, to deserve the name, should be a perfectly reversible instrument, receiving and giving out power like a dynamo motor, without any deterioration of the mechanism of conversion. The present lead storage battery in an automobile does not meet this condition. It gradually becomes less and less efficient and in a few months wholly inoperative. The acid environment prevents a proper mechanical construction, its chemical reactions are of the most capricious character; it must be watched and treated with great care—so great care, indeed, as to make it impracticable for general use. It can be made, as far as mere weight is concerned, of sufficient lightness to meet all the wants of commerce and pleasure; but, if made light, it rapidly becomes useless.

On the other hand, the nickel-iron storage cell has an ideal environment. Being in an alkaline solution, none of the ingredients is attacked by the solution in any degree. The chemical reactions are also of the most simple and stable character. The conditions permit of a perfect mechanical construction, and, finally, it remains uninjured under any condition which one could imagine, when in the hands of an inexpert. The weight can be made to meet every exigency of commercial vehicle traction, and up to the present time there are no signs of chemical deterioration, even in a battery which has been charged and discharged over 700 times.

I have been working for a number of years on the problem of a true storage battery. The experiments have been continuous for the past three years. The above may be considered the first stage.

Tests on the battery have been going on for over a year and a half; this was the second stage.

The construction of chemical works and a manufacturing plant for the cells was the third stage.

The manufacture of standard cells from the tools is the fourth stage.

Twenty-one cells made in the factories, weighing 332 pounds, were placed in a Baker automobile, the total weight with two men in the vehicle being 1,075 pounds. The vehicle made a run, on one charge, of sixty-two miles over country roads, containing many grades, some as steep as twelve feet in a hundred. At the end of this run the vehicle was making eighty-three per cent. of the original speed. The average speed over the entire distance

was 11.2 miles per hour. On a comparatively level country road a little heavy from a recent rain, the same vehicle on one charge came to a stop at the eighty-fifth mile.

In spite of assertions to the contrary, I think the storage battery carriage, by the aid of the new battery, will come ultimately within the reach of the man of moderate means. Driving through the many miles of streets in the suburbs of New York, I have been impressed with the fact that something like eighty per cent. of the residences have no carriage houses. The storage battery carriage, with the new battery, should enable the owners of forty per cent. of these residences to have a serviceable pleasure vehicle at their beck and call, without hiring a coachman to keep it clean and run it, with no horses to eat their heads off and no oats and hay to buy. With an initial outlay of from \$700 and upwards, the storage battery automobile can be used once a week at the cost of a fifty-cent charge, or twice for a dollar, and so on, the cost of use being met as it is incurred and so ceasing to be the bugbear that fixed charges must always be to the householder of moderate income.

For safe and successful use, the automobile must, in my opinion, be made with heavier running gear, on the lines of the later French automobiles. Especially should stability be secured in the wheels and frame; the superstructure may be made gauzy. It seems likely that two general types of electric carriage will be developed, a light buggy type and a heavier touring carriage, the battery varying accordingly.

The French types of electric carriages come nearer to my ideas in strength and stability than any other models. This result has been attained, of course, only by experience. At first I was inclined to the opinion that the French machines were abnormally heavy; but when I study out the concussions and strains to which they are subjected, my inclination is to make the touring carriage even heavier still. It is surprising to me that American builders have not more closely followed these French models, since experiments costing millions must have been made to reach the present stage.

We hear of fewer automobile accidents in France and in Europe generally than in our own country, and they are fewer in spite of heavy types of carriages. One reason for this is that in Europe there are wider roads and less traffic; another is that the public

have been educated up to the situation. The electric carriage of the future, and of the near future, will in my opinion not only supersede other types of automobiles, but it will be built and run on such practical lines that accidents will soon become things of the past. Horse owners and drivers will educate their animals, as in old times they had to be educated up to the steam engine and later to the trolley car. The electric carriage will be practically noiseless and easily stopped in an emergency. Above all, it will need no irresponsible chauffeur.

The fifth endurance test of the nickel-iron battery, which is demonstrating that the storage battery is indeed an accomplished fact, is now being made with five different models of automobiles, in each of which the new cells have been installed. They are of various weights and construction, and each of them is being run 5,000 miles over country roads, at an average distance of 100 miles per day.

If these tests shall show no loss of capacity and no mechanical defect in the battery, and that it is in all respects exactly the same at the end as at the commencement, we can be reasonably assured that at last we have a real storage battery.

THOMAS A. EDISON.